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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF HOME ECONOMICS
WASHINGTON, D. C.



NUTRITIVE VALUE OF BUTTER AND MARGARINS

Proximate Composition and Fuel Value

Butter and margarins have a considerable variation in composition, especially in the water and fat content and consequently in their fuel value. Butter is required to be at least 80 per cent fat. The fat content of oleomargarin is not regulated by Federal law and the variation is greater than in butter. The figures given are average ones for the product.

	: Water	: Protein and carbohydrates	: Fat	: Ash	: Calories per pound
	: Per cent	: Per cent	: Per cent	: Per cent	:
Butter	: 15.5	: 1	: 81	: 2.5	: 5,325
Oleomargarin	: 10	: 1	: 86	: 3	: 3,530

Bailey, E. M. Food products and drugs. Conn. Agr. Expt. Sta. Buls 210 (1918), p. 200-203; 227 (1920), p. 234-236; 236 (1921), p. 247-249.

Bartlett, J. H. Food and drugs. Maine Agr. Expt. Sta. Official Inspections 119 (1926), p. 22.

Eckles, C. H., Keithley, J. R., and Combs, W. B. Composition of creamery butter and its control. Mich. Agr. Expt. Sta. Bul. 225 (1925)

Harcourt, R. Moisture, salt and curd in butter. Thirty-second Annual Report Ontario Agr. Col. and Expt. Farm 1906, p. 72

Kiester, J. T. Nut margarins. Jour. Assoc. Official Agr. Chem., vol. 6, no. 4 (1923), p. 502-508.

Rose, R. E., and Henry, A. M. Annual Report State Chemist of Florida 1910, opposite p. 112-113.

Digestibility and Vitamin Content

Butter and margarins are similar in digestibility but in vitamin A content they differ considerably. The vitamin content of oleomargarin depends on the source of the fat and the process of manufacture. Beef fat contains some vitamin A and margarins made from it may retain a small amount of this factor. Those made from coconut fat, cottonseed oil, peanut oil, or hydrogenated vegetable oils contain none or too little to be of practical importance.

In general margarins contain little or no vitamin A, which is so abundant in butter. One margarin, however, seems to be an exception in that it has been shown to be a good source of the vitamin A factor. If margarins are to be used in the diet as butter substitutes, care must be taken to include other adequate sources of vitamin A.

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Osborne, T. B., Mendel, L. B., et al. Further observations on the influence of natural fats upon growth. Jour. Biol. Chem., vol. 20 (1915), p. 379-389. Abs. in Expt. Sta. Rec., vol. 33 (1915), p. 262.

Beef fat contains more vitamin A than lard but much less than butter fat. The fact that it contains less than butter fat may be due to its high content of the harder fats since in butter vitamin A is generally associated with the softer parts.

Halliburton, W. D., and Drummond, J. C. The nutritive value of margarins and butter substitutes with reference to their content of the fat-soluble accessory growth substance. Jour. Physiol., vol. 51 (1917), p. 235-251. Abs. in Expt. Sta. Rec., vol. 38 (1918), p. 265.

Oleo-oil contains some vitamin A and for this reason oleo-oil margarins would contain some of this factor. Margarins prepared with a basis of coconut fat, cottonseed oil, arachis (peanut) oil, or hydrogenated vegetable oils, are not equal to butter nor to oleo-oil margarins since these vegetable oils do not contain any appreciable amount of vitamin A.

Steenbock, H., Boutwell, P. W., and Kent, H. E. Fat soluble vitamin. I. Jour. Biol. Chem., vol. 35 (1918), p. 517-526. Abs. in Expt. Sta. Rec., vol. 39 (1918), p. 770.

Different butters vary in their vitamin content, according to variations in the ration, in the extent and methods of storage, etc. Most oleomargarin contains little of the liquid portions of beef fat and therefore is much inferior to butter.

Drummond, J. S. Fats and fatty acids as food. V. The fat-soluble accessory factor. Jour. Physiol., vol. 52 (1919), p. 344-346. Abs. in Expt. Sta. Rec., vol. 41 (1919), p. 361-362.

Margarins consisting of hydrogenated animal fats (e.g., whale oil which contained the vitamin before hydrogenation) have no vitamin value.

Pekelharing, C. A., and Schut, W. Investigations of the nutritive value of hardened fats. Pharm. Weekbl., vol. 53 (1916), no. 26, p. 769-785. Abs. in Expt. Sta. Rec., vol. 41 (1919), p. 362.

Rats on diets where fat consisted of hardened fats did not grow. Mice grew at customary rate and dogs assimilated most of the fat.

Holt, L. E., Courtney, A. M., and Fales, H. L. A study of the fat metabolism of infants and young children. IV. The digestion of some vegetable fats by children on a mixed diet. Amer. Jour. Diseases Children, vol. 18 (1919), no. 3, p. 157-172. Abs. in Expt. Sta. Rec., vol. 42 (1920), p. 60-61.

Clayton, W. Margarin. Pub. by Longmans, Green and Co., London and New York. 1920. Abs. in Expt. Sta. Rec., vol. 44 (1921), p. 258.

Discussion of digestibility and content of fat-soluble vitamin.

Richardson, W. D. The vitamin doctrine and the oleomargarin industry. Inst. Margarin Manfrs. Proc. 2 (1921), p. 11-26. Abs. in Expt. Sta. Rec., vol. 46 (1922), p. 256.

A plea for use of oleo in place of butter as butter making is economically wasteful due to loss of buttermilk. Other foods contain vitamin A.

Funk, C. Vitamins and the future of margarin manufacture. Chem. Age [New York], vol. 30 (1922), no. 5, p. 227-230. Abs. in Expt. Sta. Rec., vol. 47 (1922), p. 662.

Lecture. Margarins differ from butter in that they lack vitamin A. Suggests better manufacturing methods and possibly the incorporation of a small amount of cod-liver oil.

Elsdon, G. D. The analysis of margarin. Chem. Age [London], vol. 8 (1923), no. 202, p. 450-452. Abs. in Expt. Sta. Rec., vol. 49 (1923), p. 505.

Recommends including beef fat or butter fat in all margarins in order to supply the deficiency of vitamin A.

Holmes, A. D. Food values and vitamins from the manufacturers standpoint. Amer. Food Jour., vol. 18 (1923), no. 7, p. 321. Abs. in Expt. Sta. Rec., vol. 50 (1924), p. 365.

Study of manufacturing uses of oleomargarin.

Langworthy, C. F. The digestibility of fats. Jour. Indus. and Engin. Chem., vol. 15 (1923), p. 276. Abs. in Expt. Sta. Rec., vol. 49 (1923), p. 276.

Includes results of experimental work on a large number of animal and vegetable fats and hydrogenated oils. Summarizes earlier reports from the same laboratory (U. S. Dept. Agr.).

Hawk, P. B. Old and new ideas in diet. Amer. Food Jour., vol. 19 (1924), p. 379.

Margarines

Coward, K. H. The vitamin content of margarine. *The Lancet* (1928) II, 726
Abstract in *Jour. Home Econ.*, p. 612, (August, 1929) as follows:

Quantitative determination of the content of vitamins A and D in 14 samples representing 4 brands of oleomargarine advertised to contain concentrates of these vitamins and of the same number of samples of fresh butter, both being purchased simultaneously in ordinary retail shops in London, showed the margarines to be equal to the best summer butter in both A and D and to be more constant in content of vitamin D than butter.

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Fetter, D., and Carlson, A. J. The vitamin A and D content of some margarines. *Amer. Jour. Physiol.*, vol. 96, no. 2, p. 257, (February 1, 1931). Abstract in *Jour. Amer. Med. Assn.*, vol. 96, no. 16, p. 1337, (1931) as follows:

As tested on rats, an animal fat margarine churned in whole milk was found by Fetter and Carlson equal to butter in vitamin A content. A margarine with coconut oil as the fat content was very deficient in vitamin A. As tested by the cure of rickets in rats, the oleo-oil-lard-milk margarine studied was superior to butter in vitamin D content.

